DEPARTMENT OF AGRICULTURE,
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BULLETIN No. 35.

VULCANIZATION TESTS.

Investigations at the Imperial Institute on Samples of Plantation Para Rubber from Ceylon prepared in connection with the Rubber Research Scheme.

Sixth Interim Report.

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BULLETIN No. 35.

VULCANIZATION TESTS.

Investigations at the Imperial Institute on Samples of Plantation Para Rubber from Ceylon prepared in connection with the Rubber Research Scheme.

SIXTH INTERIM REPORT.

THE present report deals with the twenty-one specimens of rubber prepared by Mr. L. E. Campbell, B.Sc., the Rubber Research Chemist, which are included in Sections IV., V., and VI. of Series III. In these sections wood creosote or formalin was added to the latex as a preservative, and specimens of rubber (1) dried in the usual way, and (2) in the form of wet block or roll were then prepared for comparison. Specimens of rubber prepared in this way were included in Sections XIV. and XVI. of Series I. and II. and were dealt with in the Fourth Interim Report.

The exact method of preparation of the samples in Series III. is given in the following account.

SERIES III.

Experiments conducted with Latex from the Trees 16 to 20 Years old used for Series II.

Section IV.—Wet Block Rubber.

Date of experiment: May 23, 1914.

Rainfall: nil at 6 A.M.; rain occurred during tapping.

Percentage of dry rubber in latex: 28.

No. 203.—Control sample. Time of drying: 4 weeks.

No. 204–5.—Alkaline solution of wood creosote was added to the latex until the latter contained 0·125 per cent. by volume of creosote. The latex was then coagulated with acetic acid in the standard way; the rubber was pressed into

sheet in a Golledge hand roller and cut into "worm." A portion of the worm rubber was dried, and the remainder was converted into wet block.

No. 204.—Creosoted "worm" rubber dried on bamboo mesh in the rubber room of the factory. Time of drying: 24 hours; mean temperature: 83° F.

No. 205.—Creosoted "worm" rubber pressed into block while still wet.

Section Va.—Wet Rolled Sheet.

Date of experiment: June 10, 1914.

Rainfall: 0·98 inch.

Percentage of dry rubber in latex: 35.

No. 206.—Control sample. Time of drying: 4 weeks.

No. 207–8.—Alkaline solution of wood creosote was added to the latex so that the latter contained 0·125 per cent. of creosote. The rubber was made into sheet by the standard method. Part of the sheet was dried in the usual way, and the remainder was rolled up under tension while still wet.

No. 207.—Sheet dried in the usual way. Time of drying: 3 weeks.

No. 208.—Sheet rolled up while wet under tension sufficient to stretch it to 1¼ times its original length.

Sections Vb. and Vc.—Effect of different Amounts of Moisture in Wet Rolled Sheet: Wood Creosote as Preservative.

Section Vb.

Date of experiment: June 28, 1914.

Rainfall: 0·15 inch.

Percentage of dry rubber in latex: 34.

No. 209.—Control sample. Time of drying: 4 weeks.

No. 210.—Alkaline solution of wood creosote was added to the latex so that the latter contained 0·125 per cent. of creosote. The rubber was prepared in sheet by the standard method and rolled up wet on the day after preparation.

No. 211.—Prepared as No. 210, but the sheet rubber was rolled up three days after preparation.

No. 212.—Prepared as No. 210, but the sheet rubber was rolled up when dry. Time of drying : 3 weeks.

No. 213.—Prepared as No. 210, but the sheet rubber was dried and not rolled up.

Section Vc.

Date of experiment : June 25, 1914.

Rainfall : 3·04 inches.

Percentage of dry rubber in latex : 35.

No. 214.—Control sample. Time of drying : 4 weeks.

No. 215.—Creosoted sheet rubber rolled up wet one day after preparation.

No. 216.—Creosoted sheet rubber rolled up wet three days after preparation.

No. 217.—Creosoted sheet rubber rolled up wet seven days after preparation.

No. 218.—Creosoted sheet rubber rolled up when dry. Time of drying : 4 weeks.

In the preparation of these creosoted rubbers (Sections IV. and V.) the following points were noted by Mr. Campbell :—

(1) That the presence of the creosote emulsion in the latex tends to hasten the formation of a coherent coagulum.

(2) That the rubber which contains creosote dries more rapidly than rubber which does not contain it. In the case of sheet, this difference is not readily observable, for the reason that sheets do not dry evenly ; a comparison is thus difficult. With crêpe the difference is much more easily noticeable.

(3) That the wet sheet should not be rolled up immediately after passing through the rolling machine, but should be hung up for some hours so that the superficial water can drain off. By this procedure it is possible to avoid the offensive smell and sliminess of rolls made from rubber which has just been passed through the rolling machine and not allowed to dry on the surface. It is sufficient to allow the sheets to drain for 12 hours.

Section VI.—Effect of different Amounts of Moisture in Wet Rolled Sheet : Formalin as Preservative.

Date of experiment : July 1, 1914.

Rainfall : 0·44 inch.

Percentage of dry rubber in latex : 28.

Formalin was added to the latex corresponding to 0·5 per cent. of pure formaldehyde.

No. 219.—Control sample. Time of drying : 4 weeks.

No. 220.—Sheet rolled up wet one day after preparation.

No. 221.—Sheet rolled up wet three days after preparation.

No. 222.—Sheet rolled up when dry. Time of drying : 3 weeks.

No. 223.—Sheet not rolled up.

RESULTS OF EXAMINATION.

(1) Vulcanization and Mechanical Tests.

The specimens have been vulcanized and submitted to mechanical tests in exactly the same manner as the previous samples, and the results obtained are given in the following table :—

SERIES III. *Section IV.—Wet Block Rubber.*	Form of Rubber.	Serial No.	Time of Cure, Minutes, at 50 lb. Pressure.	Tensile Strength, lb. per Sq. Inch.	Elongation, per Cent.	Permanent Set, Elongation, per Cent.
Control (without creosote) ..	Sheet ..	203 ..	95 ..	2,480 ..	859 ..	2·32
Creosote added to latex, rubber made into worm and dried at 83° F.	Creosoted worm, dry	204 ..	85 ..	1,800 ..	868 ..	4·40
Creosote added to latex, but worm rubber blocked while wet	Creosoted wet worm block	205 ..	60 ..	2,490 ..	8 ..	2·26
Section Va.—Wet Rolled Sheet.						
Control (without creosote) ..	Sheet ..	206 ..	70 ..	2,500 ..	858 ..	2·41
Creosote added to latex, rubber made into sheet and dried in the usual way	Creosoted sheet, dry	207 ..	95 ..	2,300 ..	876 ..	2·52
Creosote added to latex, but sheet rolled up wet under tension sufficient to stretch it to 1¼ times its original length	Creosoted roll, wet	208 ..	55 ..	2,550 ..	887 ..	2·20
Section Vb.—Wet Rolled Sheet.						
Control (without creosote) ..	Sheet ..	209 ..	85 ..	2,490 ..	894 ..	2·67
Creosote added to latex, rubber made into sheet and rolled up wet after one day	Creosoted roll, wet	210 ..	55 ..	2,430 ..	881 ..	2·76
Creosote added to latex, but sheet rolled up wet after three days	do. ..	211 ..	60 ..	2,470 ..	880 ..	2·28
Creosote added to latex, but sheet rolled up when dry	Creosoted roll, dry	212 ..	90 ..	2,440 ..	869 ..	2·70
Creosote added to latex, but sheet dried and not rolled up	Creosoted sheet, dry	213 ..	95 ..	2,430 ..	860 ..	2·61

	Form of Rubber.	Serial No.	Time of Cure, Minutes, at 50 lb. Pressure.	Tensile Strength, lb. per Sq. Inch.	Elongation, per Cent.	Permanent Set, Elongation, per Cent.
Section Vc.—Wet Rolled Sheet.						
Control (without creosote) ..	Sheet ..	214 ..	75 ..	2,540 ..	879 ..	2·62
Creosote added to latex, rubber made into sheet and rolled up wet after one day	Creosoted roll, wet	215 ..	52 ..	2,570 ..	896 ..	2·76
Creosote added to latex, but sheet rolled up wet after three days	do. ..	216 ..	55 ..	2,370 ..	883 ..	2·50
Creosote added to latex, but sheet rolled up wet after seven days	do. ..	217 ..	62 ..	2,400 ..	870 ..	2·08
Creosote added to latex, but sheet rolled up when dry	Creosoted roll, dry	218 ..	85 ..	2,440 ..	880 ..	2·50
Section VI.—Wet Rolled Sheet.						
Control (without formalin)..	Sheet ..	219 ..	80 ..	2,380 ..	874 ..	1·90
Formalin added to latex, rubber made into sheet and rolled up wet after one day	Roll, wet..	220 ..	72 ..	2,470 ..	892 ..	1·96
Formalin added to latex, but sheet rolled up wet after three days	do. ..	221 ..	75 ..	2,450 ..	878 ..	1·68
Formalin added to latex, but sheet rolled up when dry	Roll, dry..	222 ..	95 ..	2,310 ..	889 ..	2·36
Formalin added to latex, but sheet dried and not rolled up	Sheet, dry	223 ..	105 ..	2,390 ..	895 ..	2·50

Time of Vulcanization.

As in the case of previous specimens of a similar nature (*cf.* Series I. and II., Sections XIV. and XVI.), the wet rubbers included in this report all cure more rapidly than the dry specimens from the same latex, but the differences in the times of vulcanization are smaller in the present series than in Series I. and II. The results obtained in the three series are compared in the following table :—

Time of Cure, in Minutes.

Section :	Series III. IV.	Va.	Vb.	Vc.	VI.*	Series I. Average Results. XIV.	XVI.	Series II. Average Results. XIV.	XVI.
Creosoted wet rubber	60	55	55, 60	52	72, 75	38	67†	45	65†
Creosoted dry rubber	85	95	90, 95	85	95, 105	—	—	—	—
Plain (control) sheet, dry	95	70	85	75	80	65	95‡	70	105‡

* Formalin used instead of creosote. † Wet block made from crêpe.
‡ Dry crêpe rubber.

It will be seen from these figures that none of the wet specimens in Sections IV. to VI. of Series III. had a time of cure less than 52 minutes, whereas similar specimens of wet roll (creosoted) rubber examined previously required only 38 minutes cure in certain cases (Nos. 83, 84, 85). It is, however, quite clear that the wet rubbers have a much shorter time of cure than the dry specimens. The results also indicate that the rubber containing the largest amount of moisture cures in the shortest time, *e.g.*, in Section Vc the sheet rolled up wet after one and three days cured much quicker than that rolled up when partially dry after seven days.

With reference to the longer time of cure required by the wet specimens in Series III. as compared with those in Series I. and II., it may be noted that the control specimens in the three series also show a similar difference. The times of cure of the five control specimens included in this report (Series III.) ranged from 70 to 95 minutes, with an average of 81 minutes; in the case of 18 control samples of Series I. the average time of cure was 66·6 minutes, and only one of the eighteen required over 75 minutes; whilst in Series II. the average time of cure of eight control samples was 71 minutes, with a maximum of 75 minutes. It may be mentioned that the samples of Series III. were made from the same trees as were used for Series II., and it is of interest that the time of cure of the control samples, prepared from the latex in exactly the same way, shows considerable variation in the two cases. It is evident that, as was pointed out in the Fourth Interim Report, marked differences in the time of vulcanization may occur in rubbers prepared at different times from the same trees by identical methods.

The specimens of dry creosoted sheet rubber in Sections Va, Vb, Vc have a distinctly longer time of cure than the plain (not creosoted) sheet from the same latex. Previous specimens of dry creosoted sheet rubber (*e.g.*, Nos. 69 and 150) did not differ appreciably in time of cure from plain sheet (Controls C 9 and C 20) made from the same bulk latex. It would appear, however, from the results now recorded that the addition of alkaline creosote solution to the latex before coagulation may lengthen the time of cure.

In Section VI. the samples prepared from latex containing formalin and rolled up while wet cure much more quickly than the corresponding samples of dry sheet or roll containing formalin. The latter samples have a distinctly longer time of cure than the plain control sheet prepared without the addition of formalin. Formalin has been shown already to lengthen the time of cure when added to the latex before coagulation (*c.f.* Series I. and II., Section IV., Sub-section 3).

Mechanical Results.

With one exception (No. 204, dry worm rubber), all the specimens included in the present report have given very good results in the mechanical tests. Excluding No. 204, the figures for tensile strength range from 2,300 to 2,500 lb. per square inch, with an average value of 2,445 lb. for the twenty specimens. This is a higher average value for tensile strength than that given by the samples included in any of the previous reports.

Specimen No. 204, which was in the form of "worm," and had been dried at a temperature of 83° F., gave a very poor result in the tensile tests, only 1,800 lb. per square inch, but it is noteworthy that the block rubber (No. 205) made from a portion of the same worm rubber when wet had a very much higher value, viz., 2,490 lb. per square inch, which is equal to the tensile strength of the control sample.

In all cases the wet rubbers, prepared by the addition of creosote or formalin to the latex, are of very good quality, as is evident from the following table giving the average results obtained in the present series and in Series I. and II., Section XIV.:—

Series III.—Sections IV, Va, Vb, Vc.	Tensile Strength, lb. per Sq. Inch.	Elongation, per Cent.	Permanent Set, per Cent.
Wet roll or block, creosoted (Nos. 205, 208, 210, 211, 215, 216, 217)	2,470	883	2·40
Controls (Nos. 203, 206, 209, 214)	2,500	873	2·50
Series III.—Section VI.			
Wet roll, formalin (Nos. 220, 221)	2,460	885	1·82
Control No. 219	2,380	874	1·90

	Tensile Strength, lb. per sq. inch.	Elongation, per Cent.	Permanent Set, per Cent.
Series I.—Section XIV.			
Wet roll, creosoted (Nos. 83, 84, 85)	2,430	867	2·93
Control (No. C 12)	2,470	881	2·11
Series II.—Section XIV.			
Wet roll, creosoted (Nos. 162, 163, 164)	2,600	882	2·58
Control No. C 21	2,450	879	2·71
Plain sheet (average of twenty-six controls, Series I. and II.)	2,385	870	2·52*

* Average of 19 samples only.

It will be seen from these results that the wet rubbers have given very good results in the tensile tests, the values obtained being, on the whole, quite equal to those furnished by plain dry sheet from the same latex.

In Section *Va* the creosoted rubber, which was rolled up wet under tension, had a much higher tensile strength than the creosoted sheet rubber dried in the same usual way, the figures being 2,550 lb. and 2,300 lb. respectively, but the former value is practically the same as that of the control sheet, which gave 2,500 lb.

Chemical Composition.

The results of the chemical examination of the samples are given in the following table :—

Series III.	Form of Rubber.	Serial No.	Loss on washing. Per Cent.	Composition of dry washed Rubber. Caoutchouc. Per Cent.	Resin. Per Cent.	Protein. Per Cent.	Ash. Per Cent.
Section IV.—Wet Block Rubber.							
Control (without creosote)	Sheet	203	0·36	95·66	2·10	2·03	0·21
Creosote added to latex, rubber made into worm and dried at 83° F.	Creosoted worm, dry	204	0·54	94·70	2·58	2·41	0·31
Creosote added to latex, but worm rubber blocked while wet	Creosoted wet worm block	205	6·83	95·05	2·61	2·14	0·20
Section Va.—Wet Rolled Sheet.							
Control (without creosote)	Sheet	206	—	95·33	2·33	2·11	0·23
Creosote added to latex, rubber made into sheet and dried in the usual way	Creosoted sheet, dry	207	0·36	95·52	2·23	2·05	0·20
Creosote added to latex, but sheet rolled up wet under tension sufficient to stretch it to 1¼ times its original length	Creosoted roll, wet	208	4·26	94·54	3·30	1·96	0·20

	Form of Rubber.	Serial No.	Loss on washing. Per Cent.	Composition of dry washed Rubber. Caoutchouc. Per Cent.	Resin. Per Cent.	Protein. Per Cent.	Ash. Per Cent.
Section Vb.—Wet Rolled Sheet.							
Control (without creosote)	Sheet	209	0·45	95·26	2·17	2·37	0·20
Creosote added to latex, rubber made into sheet and rolled up wet after one day	Creosoted roll, wet	210	4·45	94·46	3·20	2·08	0·26
Creosote added to latex, but sheet rolled up wet after three days	do.	211	2·05	94·67	3·00	2·07	0·26
Creosote added to latex, but sheet rolled up when dry	Creosoted roll, dry	212	0·61	94·53	3·02	2·21	0·24
Creosote added to latex, but sheet dried and not rolled up	Creosoted sheet, dry	213	0·38	95·69	1·80	2·21	0·30
Section Vc.—Wet Rolled Sheet.							
Control (without creosote)	Sheet	214	0·34	95·39	2·15	2·21	0·25
Creosote added to latex, rubber made into sheet and rolled up wet after one day	Creosoted roll, wet	215	11·10	94·27	3·55	1·97	0·21
Creosote added to latex, but sheet rolled up wet after three days	do.	216	3·25	94·61	3·29	1·88	0·22
Creosote added to latex, but sheet rolled up wet after seven days	do.	217	1·40	94·75	3·03	1·98	0·24
Creosote added to latex, but sheet rolled up when dry	Creosoted roll, dry	218	0·53	94·88	2·86	2·00	0·26
Section VI.—Wet Rolled Sheet.							
Control (without formalin)	Sheet	219	0·39	95·89	1·91	1·96	0·24
Formalin added to latex, rubber made into sheet and rolled up wet after one day	Roll, wet	220	5·06	94·73	3·08	1·96	0·23
Formalin added to latex, but sheet rolled up wet after three days	do.	221	2·79	94·81	2·97	2·00	0·22
Formalin added to latex, but sheet rolled up when dry	Roll, dry	222	0·50	94·66	2·85	2·24	0·25
Formalin added to latex, but sheet dried and not rolled up	Sheet, dry	223	0·19	95·71	1·95	2·12	0·22

In dealing with the specimens of Section XIV. in Series I. and II. (see Fourth Interim Report), attempts were made to ascertain if there were any marked differences in chemical

composition between the dry and the wet roll rubbers. From the results obtained it appeared that—

(1) The amount of resin was higher in the wet rubbers than in the dry rubber from the same bulk latex, and that the resin was highest in those rubbers which cured quickest.

(2) The amount of protein was consistently lower in the wet roll rubbers than in the dry rubbers, after each had been washed and dried in the usual way.

A further investigation of these points has been made in connection with the present samples.

The average composition of the wet and dry specimens included in Sections V*a*, V*b*, V*c*, and VI. of Series III. is given in the following table :—

	Caoutchouc. Per Cent.	Resin. Per Cent.	Protein. Per Cent.	Time of Vulcanization. Minutes at 50 lb. Pressure.
(1) Creosoted roll (Sections V*a*, V*b*, and V*c*) :—				
Dry	95·15	2·48	2·12	91
Wet	94·55	3·23	1·99	56
(2) Rubber preserved with formalin (Section VI.) :—				
Dry	95·18	2·40	2·18	100
Wet	94·77	2·94	1·98	73

It will be seen that in both these groups the wet quick-curing rubber contains a higher percentage of resin and a lower percentage of protein than the dry rubber prepared from the same bulk latex. No definite relationship between the amounts of protein and the time of vulcanization is apparent in these samples, as the two groups of wet rubbers containing on the average 1·99 and 1·98 per cent. of protein differed considerably in time of vulcanization, the average figures being 56 and 73 minutes respectively.

Resin.—The following table gives the percentages of resin and the times of cure of the samples in Sections V*a*, V*b*, V*c*, and VI. in Series III. compared with the average figures for the similar samples in Series I. and II.

Resin Percentages and Times of Cure.

Series I.		Control Sheet (no Creosote).	Creosoted Sheet, rolled wet.	Creosoted Sheet, rolled wet, after 1 Day.	Creosoted Sheet, rolled wet, after 3 Days.	Creosoted Sheet, rolled wet, after 7 Days.	Creosoted Sheet, rolled when dry.	Creosoted Sheet, dry, not rolled.
Section XIV. (average):—								
Creosoted .. Resin ..	Per cent.	2·48	3·92	—	—	—	—	—
Creosoted .. Time of cure ..	Minutes	65	38	—	—	—	—	—
Series II.								
Section XIV. (average):—								
Creosoted .. Resin ..	Per cent.	2·97	3·36	—	—	—	—	—
Creosoted .. Time of cure ..	Minutes	70	45	—	—	—	—	—
Series III.								
Section V*a*:—								
Creosoted .. Resin ..	Per cent.	2·33	3·30	—	—	—	—	2·23
Creosoted .. Time of cure ..	Minutes	70	55	—	—	—	—	95
Section V*b*:—								
Creosoted .. Resin ..	Per cent.	2·17	—	3·20	3·00	—	3·02	1·80
Creosoted .. Time of cure ..	Minutes	85	—	55	60	—	90	95
Section V*c*:—								
Creosoted .. Resin ..	Per cent.	2·15	—	3·55	3·29	3·03	2·86	—
Creosoted .. Time of cure ..	Minutes	75	—	52	55	62	85	—
Section VI.:—								
Formalin .. Resin ..	Per cent.	1·91	—	3·08	2·97	—	2·85	1·95
Formalin .. Time of cure ..	Minutes	80	—	72	75	—	95	105

From the figures given in the preceding table it is evident that the wet rubbers contain more resin than the dry rubbers prepared from the same latex, and that of the wet rubbers the samples which were rolled up shortly after coagulation contain more resin than those kept for a few days before rolling (and therefore allowed to dry partially). It appears further that a high proportion of resin is again generally associated with rapid cure. That the high percentage of resin is not due to the inclusion of creosote in the "resin" as extracted by acetone is apparent from the facts—

(1) That the resin in dry sheet prepared with creosote is not higher than in sheet from the same latex prepared without creosote.

(2) That the wet rolled samples prepared with formalin show the same higher percentage of resin compared with samples from the same latex without formalin.

The fact that the samples which are rolled up soonest generally contain the highest amounts of resin suggests that some of the "resin" may be lost in the liquid which exudes from the sheets during drying, or that a portion of the "resin" becomes insoluble in acetone when the sheet is dried in the usual way.

A curious point which will require further investigation is that the sheet rubber prepared with creosote or formalin and rolled up when dry contains a larger amount of resin than the similar dry sheets which were not rolled up.

Protein.—The results obtained with the previous specimens of wet and dry roll rubbers in Series I. and II. (Section XIV.) showed that after the rubbers were washed and dried in the usual way the percentage of protein was invariably higher in the dry rubber than in the corresponding samples of wet rubber. In Section XIV. of Series I. the average amounts of protein in the samples of dry and wet rubbers were 2·36 and 1·89 per cent. respectively, and in Series II. the figures were 2·41 and 2·16 per cent. (see Fourth Interim Report). A comparison of the analyses of the dry and wet rubbers dealt with in the present report shows that this is also true of the present samples, but that the differences in the percentages of

protein are much less than in the previous series. The figures for Series III. are summarized in the following table :—

	IV. Per Cent.	Va. Per Cent.	Vb. Per Cent.	Vc. Per Cent.	VI. Per Cent.
Protein in—					
Dry rubber..	2·41	2·05	2·21	2·00	2·18
Wet rubber..	2·14	1·96	2·08	1·94	1·98
Difference ..	0·27	0·09	0·13	0·06	0·20

The average difference in the amounts of protein in the dry and wet rubbers of Series III. is therefore 0·15 per cent. compared with 0·47 per cent. in Series I. and 0·25 per cent. in Series II.

It was also found in the case of two previous specimens that protein was removed during the washing of wet roll rubbers (see Fourth Interim Report), and experiments were therefore made to ascertain whether the wet roll rubbers of Series III. gave similar results. For this purpose seven samples of wet rubber (Nos. 205, 208, 210, 211, 215, 220, and 221) were examined chemically (1) without washing (the rubber as received being merely cut up for analysis), and (2) after washing and drying in the usual way. The results are given in the following table :—

	No. 205. Per Cent.	No. 208. Per Cent.	No. 210. Per Cent.	No. 211. Per Cent.	No. 215. Per Cent.	No. 220. Per Cent.	No. 221. Per Cent.
Protein in rubber—							
Not washed ..	2·20..	2·09..	2·26..	2·12..	2·28..	2·28..	2·25
Washed ..	2·14..	1·96..	2·08..	20·7..	1·97..	1·96..	2·00
Loss on washing	0·06	0·13	0·18	0·05	0·31	0·32	0·25

The average loss of protein on washing was therefore 0·18 per cent., compared with losses of 0·15 per cent. in a previous sample of wet roll rubber and 0·62 per cent. in a specimen of wet rubber prepared by evaporating the latex to dryness in a vacuum drier. It has been found, however, that some loss of protein also takes place in washing rubber which has been dried in the usual way soon after coagulation, the loss in the case of specimens Nos. 213 and 218 being 0·034 and 0·09 per cent., respectively. This question of the loss of protein on washing wet and dry rubbers, and the effect of this loss on the vulcanizing properties of the washed rubber as compared with

the unwashed, requires further investigation. The present specimens were not sufficiently large for the purpose, and the work will have to be deferred until the further specimens of wet rubber already asked for are received.

Conclusions.

The results recorded in this report confirm the previous conclusion that rubber prepared in such a way as to remain moist for a considerable period invariably cures more rapidly than rubber prepared from the same latex and dried thoroughly soon after coagulation. The rubbers retaining most moisture appear to cure more quickly than those containing less water. It is of interest to notice that this effect is produced even when preservatives, such as creosote and formalin, are added to the latex before coagulation.

Rubber allowed to remain in a moist condition almost invariably gives excellent results in the mechanical tests. Such rubber appears to be quite equal in physical properties to rubber from the same latex which is dried thoroughly soon after coagulation, and has a much quicker rate of cure.

As in the case of previous samples, the wet quick-curing rubbers contain larger amounts of resin and smaller amounts of protein than the dry rubber prepared from the same latex, but the investigation of the possible relationship between the percentages of resin and protein and the time of vulcanization cannot be carried further until the receipt of the additional samples of wet rubber which have been prepared for the purpose.

It is of interest to note that the control samples of Series III. have a distinctly longer time of cure than those of Series II., although both series were prepared from latex obtained from the same group of trees. This fact confirms the previous results recorded in the Fourth Interim Report, and indicates that considerable variation in time of cure may occur in plantation rubber prepared at different times from the same trees by identical methods.

August 31, 1917.